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Designing Behaviours in Design Education

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ABSTRACT

As everyday products increasingly have the capacity to sense, make decisions, analyse and learn, designers need to understand the potential complexity and cross-disciplinary nature of designing 'behaviours' in interaction. If products are to become adaptable open-system learning sentients it may be that to design 'effective behaviour' demands that products become independent agents that have a flexible multi-purposeness leading to 'learnt, controlled and communicated sustainable behaviour'. If Human agency is the capacity for human beings to make choices and to impose those choices on the world, there may be a need to examine the implications of a non-human agency making choices and imposing those choices on the world. Artificial Social Intelligence [1] may need to be expanded beyond how robots interact [2] to a reflection on 'designing socially acceptable intelligent artefacts'.

To design 'interaction' is already a highly complex environment. Behaviours cannot be designed like you would a product feature. How can we develop a design education that allows Designers, Scientists and Engineers to develop tools and methods to allow a greater inclusion in intelligent product and service development?

Alan Murray will use his experience as former Guest Director of the Funlab at the Design Academy Eindhoven, as former co-creator and Director of Design at the Faculty of Industrial Design, Technical University Eindhoven and as co-creator and Co-Director of Design Informatics at the University of Edinburgh to propose how we might effectively collaborate to develop multi-disciplinary teams to design speculatively in complex environments.

Author Keywords

Designing Behaviours; artificial intelligence; domestication; industrial design; design education; Synthetic Biology; ubiquity; intelligent products and services

INTRODUCTION

Ubiquitous computing (ubicomp) has been on the periphery of everyday life for sometime, and the majority of industry proposals for this technology lean towards utopian notions of efficiency and purpose. According to the Ericsson 'Thinking Ahead' [3] online forum: 'The connected devices revolution is about offering a higher level of convenience and security and giving us more time to do what we want. It's about boosting efficiency for enterprises and society' (2011).

Connecting objects to the Internet will create a spiraling system of increasing amounts of data and in turn, automation blurring the boundaries between ourselves and our ever present surrounding digital systems [4].

'Design' has different meanings in a variety of disciplines. For example, Design Engineers have responsibility for the total system as well as the inner workings/engineering of a design. Traditionally the industrial designer may have had responsibility for the conceptual aesthetic and ergonomic aspects of a design but if products are to become adaptable open-system learning sentients we need to educate a new breed of designer who understands the complicated language and methods of the interdisciplinary, applied and social sciences and can work as a fulcrum in multi-disciplinary environments to design innovation into emerging products and systems.

EMERGING NETWORKS

Alan Murray has been carrying out research in the form of a database of recorded video interviews with designers, scientists and engineers in the field of Designing Object Behaviour (designingbehaviour.info), speculatively exploring how networked intelligent products may begin to emerge and be appropriated.

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Figure 1. From recorded Skype interview with Prof. Robin Williams (www.designingbehaviours.info)

Prof. Robin Williams (Social Scientist): *"I think systems are going to emerge designed by people for particular sets of purposes, and by all means those purposes will evolve, and there'll be reconfigured by users, so they will have an emergent property that will evolve over time, but human purposes will permeate these systems. We're not going to see... a kind of network out of control, I'm doubtful we're going to see that, because there's a lot of time and energy needed to develop functionality. And so that functionality is going to be developed by particular social actors, economic actors, for particular social and political purposes, so it's not going to be an "anything goes" world, it's going to be a world where certain vision of the future are articulated and projected, and then we will need to engage with those visions and we may react enthusiastically or resistantly to those emerging functionalities.*

I think we're going to get fairly simple forms of adaptiveness quite quickly, and of course there is an agenda which is, kind of, medium-term future, which that we're moving into a context where, of an instrumented world and we've got wireless networks in every building and all your, your fridge is networked, and this is going to yield huge amounts information, and also where my mobile phone is telling people where we are at any moment, so, complex, possibly AI-based, systems will be needed to manage that information, and so there is in the medium term a need to have tools that will make sense of, and make meaningful interpretations of, the behaviour of people in this wired world, and so there are going to be some quite interesting quite, challenging things coming forwards.

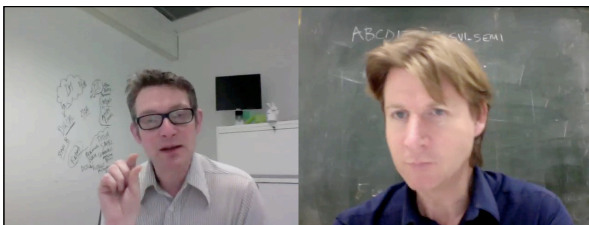


Figure 2. From recorded Skype interview with Dr Chris Speed (www.designingbehaviours.info)

Dr Chris Speed (Designer): *"the products, (holds up drinks can and coffee mug) have immaterial identities, for want of a better word, or they begin to have agency, then actually what these things begin to put together themselves without our taking part might be very interesting. So I wouldn't assume that designing product behaviour is anything to do with humans any more, but it might have something to do with humans, and actants, things will be party to that, those changes."*

CHALLENGE OF DESIGNING FOR THE EMERGING TECHNOLOGIES

Although the emergence of these technologies may be focused, it must not be under-estimated how difficult it will be to design in an intelligent artifact environment. Until now, designers have dealt with a much more linear design process. Initially designers made artefacts. Then they began to design interaction and services around those artefacts. If everyday objects can sense, make decisions, analyse, and learn, designers will be designing 'learning environments'. This will be a much more difficult and complex environment to design for. As an analogy, it is interesting to reflect on a synthetic biologists approach to designing behaviour into biological systems:

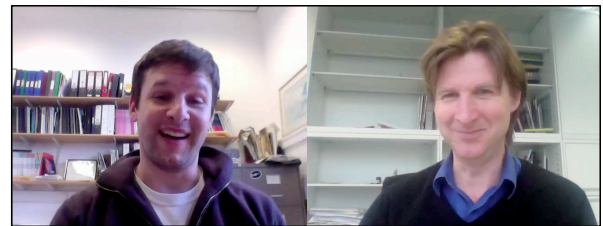


Figure 3. From recorded Skype interview with Dr Alistair Elfick (www.designingbehaviours.info)

Dr Alistair Elfick (Synthetic Biologist): *"biology does this really awkward thing, of evolving, so evolution is inherently the sort of adaptability that these open source, open system biologists... because it's engineered into an organism, the system inherently has an adaptability, it's inherently always learning about its environment, its context, so, even the simplest thing, even a bacteria, it's always sensing its environment, it's always trying to adapt, so if an antibiotic drug comes in biology will adapt so that some survive, and if the food changes the biology adapts, such that the new source of food can be exploited. So that sort of adaptability in systems is, I think it's part and parcel of the biologic, and in trying to engineer functional behaviour into a biological system, evolution is, at the same time a fantastic opportunity, and a complete pain. So most things that we try and introduce a function into, very quickly will evolve that function back out again... the cell doesn't really want to do X, so I'm just going to evolve back to being my normal self... so when we put a change, when we put a function into a cell, they often*

adapt that function out, evolve it out, but at the same time, potentially it's a real opportunity for us, to embrace this whole different way of engineering, so instead of imposing a function, we select towards a function, we kind of in a way sculpt the system towards what we want it to be, rather than cast it immediately into exactly the instance that we want to see it in."

"So in a way it's like spinning plates, but trying to spin plates without knowing whether the plate's there or not, if that makes sense, so for much of biology, even the simplest sort of biology you think of, like a single cell bacteria, we've still got a huge amount left to learn, so one of the difficulties about engineering things is, we're not actually sure of the exact context into which we're engineering, so it's like spinning plates, but also it's about keeping plates that you don't know are there still spinning."

GROUNDING THE DESIGN PROCESS

For the designer to act as 'multidisciplinary fulcrum' it is essential to be integral to the process from the beginning. By definition, a 'technology push' launches systems with set parameters that may be difficult for designers to exploit fully. Examples of recent technology pushes are: Ubiquitous computing (Xerox), Pervasive computing (IBM), Aware computing (Georgia Institute of Technology), Ambient intelligence (Philips), Intelligent environments (Microsoft), Sentient computing (AT&T), Augmented spaces (Sony) and Smart Planet (IBM).

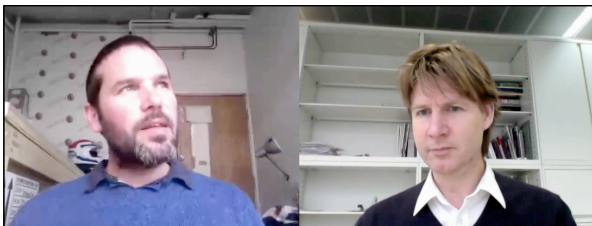


Figure 4. From recorded Skype interview with James Auger (www.designingbehaviours.info)

James Auger (Designer): *"...Charles Eames, and his definition of design [5], which is "a plan for arranging elements in such a way as to best accomplish a particular purpose"... I think this is a key aspect for the designer be thinking about is, what is the purpose of the product, and as the product becomes more complex, through the application of emerging technology, the role of the designer is to really start questioning this idea of purpose... you could have just used the word "function", which would have been very straightforward, the function of a toaster is to turn bread into toast, of a washing machines to clean clothes... if we start asking the deeper question of purpose... we can sort of explore the role of products on a much deeper level, as the product becomes more complex, and really start to think*

about what do we want from our future technological lives."

Prof Robin Williams: *"We remember lasers which were death weapons from space, but actually they always became CDs, so it is difficult to anticipate these things, and we see instead, these extended processes, which we've described as social learning, as you mention, of trial and error, as users and experts struggle to find out the affordance of new technologies and put them to their particular purposes and make them useful in their context of use. And so, artefacts and applications have to be reinvented by, not just by the designers but also various intermediate and final users, and in so doing, the artefact changes and its use, and understandings of it."*

An example of how a simple social interaction may be difficult to design for is a lift in a tall building:

- Too many people get into a lift
- How does the lift (with an intelligent learning behaviour) ask someone to leave the lift?

i.	Ask the heaviest to get out
ii.	Ask the youngest to get out
iii.	Ask the fittest to get out
iv.	Ask those it knows are not in a hurry
v.	Ask those it knows are doing fitness exercise
vi.	Ask those it knows are not doing fitness exercise
vii.	Ask those it knows are only going to Level 2
viii.	Ask those it knows have not been asked before
ix.	Ask those it knows will react best
x.	Ask randomly
xi.	Ask the people in the lift to decide

With his 'Random Lift Button' [6], Dr Chris Speed explored an alternative option to exploit 'the lost space'.

PRODUCT DOMESTICATION

The ability for products to become further incorporated into the routines of daily life means that they better adhere to Silverstone's third stage in the domestication process: They effectively become more domestic [7].

One outcome of Murray's Designing Behaviour interviews (designingbehaviour.info) explores the theme of product domestication. Essentially designers, scientists and engineers would be developing 'Environments for products to learn'.

James Auger: *"if you could read the genome of the dog like a book, you would understand a lot about who we are as humans, human desire... So you have... approximately.. 15,000 years of shaping, with selective breeding and so on, for the dog to become something that we want, and that's, that process has been extremely long winded, its*

complicated, it's gone through a utilitarian process... operating alongside the human as a hunter, status symbols... until you get to the stage where we are now, where they're being dressed up as Princess Leah in silly costumes and they're going around in people's handbags, you know, the roles that dogs have today, are extremely profound when you look at where they've come from, wild dogs, the wolf, and so on. And so dogs are an amazing example of, of this complexity of human desire, and I think we need to embrace and acknowledge that complexity... domesticate emerging technologies, to make them as useful... as meaningful as the dog in life today."

Dr Alistair Elfick: *"the family pet is a fantastic example of a product, where its whole reason for existence is a behaviour, and an interaction with mankind, so I think... it's a normalisation... there are these biological systems which have behaviours we've been interacting with, and we've gained benefit from those interactions, and maybe there's this potential future, where we can, in a much more... precise way that we engineer organisms, we can create systems, biological systems that we interact with."*

Dr Chris Speed: *"[it] might be closer to having an animal in your life. I say animal, not pet, because we've got friends with chickens, and they seem to treat them differently to... we've got cats, so it seems that actually behaviour and relationships with animals may well be a better model for understanding how we might start dealing with things, for example feral things. If it's a feral cat, or a fox, I treat it totally different to my two cats. Actually I treat my cats inconsistently. If another cat comes into my garden, I'll throw stones at it, not that may well harm it, but to scare it away actually and I probably expect other people to be throwing stones at my cats, so it is very inconsistent."*

It maybe that domestication leads to a User training a product or service to purposely exude danger as a reflection of identity:

Dr Chris Speed: *"I saw a fox, and it scared the pants off me because I don't see foxes very often, and it looked like a mythical creature, so I was, caught, and then a lot of foxes, also, can be quite sinister, or dangerous, or threatening in children's stories, you know, it's a fox, it's wily, So when I saw the fox, and the fox saw me, it was this very strange moment of "crikey". That is going to start happening with some objects, we're not going to quite know who's got the power here"*

By definition, the domestication of a product or service will automatically create a learning environment for both the object/service and the individual. The probing, questioning, sensing and testing to develop socially acceptable behaviour is a normal part of the domestication process and would be a useful exploratory metaphor.

The domestication of emerging products and services may lead to an emotional investment on the Users behalf. Consequently a User may see this as an extension of their own thinking and acting self. It is feasible that this could extend a product or services meaningful life-cycle. In extreme cases, this 'protective and promoting' relationship with emerging intelligent products could ensure 'undying support' and an 'unrestricted investment in sustainability' in the same way that, on the whole we have an undying and unrestricted love and commitment to domestic pets.

EDUCATIONAL MODELS

A number of educational models have been developed to explore effective collaboration to design speculatively in complex environments. In the Department of Industrial Design at the Technical University Eindhoven (TU/e.ID), the educational paradigm involved both active and reflective use of knowledge. As argued by Driscoll [8] on constructivist learning conditions, it intends to include the following: "1. Embed learning in complex, realistic and relevant environments; 2. Provide for social negotiation as an integral part of learning; 3. Support multiple perspectives and the use of multiple modes of representation in learning; 4. Encourage ownership in learning; 5. Nurture self-awareness of the knowledge construction process".

The goal at TU/e.ID was to develop a curriculum to create a new type of Design Engineer. To do this a 'collision' between Design and Engineering was created to produce a hybrid. Instead of exams and lectures the students would develop a digital 'Educational Portfolio'. Students would document their work and reflect on the development through a competency framework (Figure 5), always working in teams on projects with clients from industry.

The education model was developed to support and enhance students' personal development through competency and vision relating to design. Essentially students were invited to become the hybrid; to develop their competencies through a competency framework enabling them to understand a wide spectrum of vocabularies and approaches that would equip them to become the 'bridge' between disciplines.

At the Design Academy Eindhoven, design students were encouraged to work in 'Compass Departments' for two days a week. The departments were Atelier; Market; Forum and Lab (Figure 6). To encourage an alternative way of thinking and designing, students were asked to take normal practices in one compass department (e.g. 'making' in Atelier) and apply it to another department e.g. 'making' in Forum, exploring contexts in Lab, developing discussion in Atelier.

At the University of Edinburgh the School of Informatics and the School of Design (ECA) have created the Centre for Design Informatics. This is to explore the territory between the 'age-old' landscape of Design and the emerging



Figure 5. Competency Framework at the Faculty of Industrial Design, the Technical University of Eindhoven, the Netherlands

research and teaching structures. Design should be encouraged and required to develop research, programmes and courses that actively develop opportunities for effective innovative collaboration across disciplines beyond local structures.

SUMMARY

Networks are emerging of everyday products that have either actual or perceived artificial intelligence. Designers will soon need to consider how to design learning behaviours for everyday networked objects in multidisciplinary teams with engineers and scientists. To design in this environment proliferates the complexity of relationship between object/service and User.

landscape of the Computer Sciences (Informatics). The vision for the Postgraduate is:

- Learning practice and theory of information are indivisible, and
- takes place most effectively in human contexts that are messy, open-ended, and
- often place irreconcilable demands on embedded informational systems but,
- have the potential to transform the quality of people's lives.

Students enter the Postgraduate with 'extensive knowledge' from their own disciplines and are expected to deepen their knowledge through courses in their respective Schools (Design and Informatics). The focal point for learning is through multi-disciplinary group projects that explore societal challenges. Students are not expected to have knowledge of all relevant competencies related to Design Informatics, but to instead deepen their discipline specific knowledge and find creative ways to use that knowledge in multi-disciplinary environments.

To effectively collaborate, design must find ways to work across disciplines. Within a University structure design may be located in an organisation of either Science and Engineering or the Humanities. Consequently it can be onerous to find catalysts for change through existing

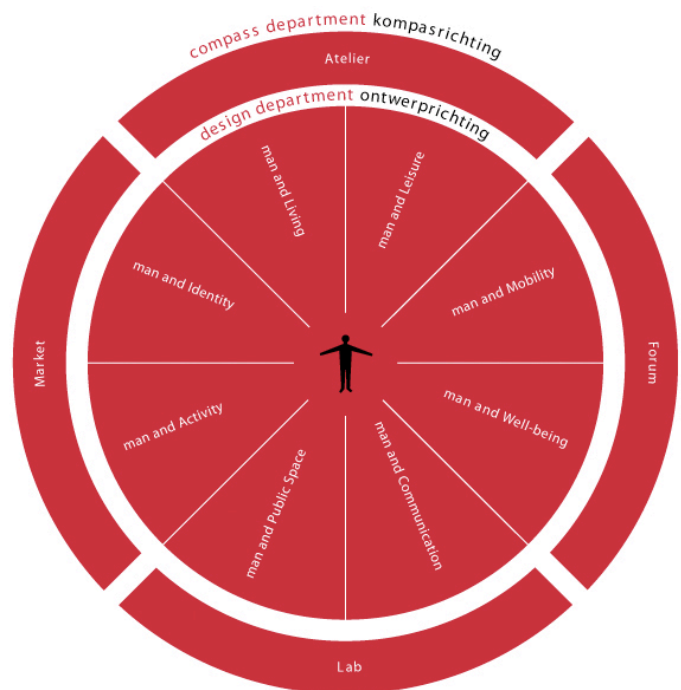


Figure 6. Compass Department at the Design Academy Eindhoven, the Netherlands

If design education can begin to anticipate the multi-disciplinary opportunities when everyday products increasingly have the capacity to sense, make decisions, analyse and learn it may be possible to develop educational models that enable designers to be involved in the whole process of intelligent product and system development.

ACKNOWLEDGMENTS

Designing Behaviours (www.designingbehaviours.info) is ongoing research by Alan Murray to develop a shared 'behaviour vocabulary' to allow multidisciplinary teams to design effective behaviour for everyday products.

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